PROFIDATA

MARKET RISK REPORT
Flatten the curve

April 2020

Executive summary

- **Volatilities were massively up.** Equity markets and Commodities volatility skyrocketed.
- **Realized volatility** (of the Euro Stoxx 50 index over 30 days) **almost tripled from 25.5% to 75%** (high).
- **All the observed equity markets closed the month in a loss position.** Sector volatilities spanned a range of 25.2% to 130.4% and were all high.
- **Sovereign bond price moves were mixed:** Germany and Japan closed with negative price movements, with 2.8% and 0.9% lost respectively; US gained 3.1%, and Italy closed with no change. **Volatility moves were all upwards**. **Volatility regimes** spanned a range of 3.4% to 7.9% and were all high.
- **FX moves against the EUR were mixed.** Euro lost 0.9% against the US Dollar, lost 1.7% against the Japanese Yen, lost 0.7% against the Swiss Franc and gained 2.5% against the British Pound. **FX volatility moves were all upwards.** FX Volatility is ranging between 3.8% and 16.9%, with US Dollar being the highest mover (€/$ rose 7.7% to 15.9% - medium up to high-).
- **Option** volatility spiked both in Europe (Vstoxx) and in the US (Vix).
- **Commodities' price moves were mixed**: Oil (Brent) lost 51%, Gold gained 0.7%, Copper lost 14.6%, Iron Ore experienced no change in price. **Volatilities were all up;** regimes moved all up to high**,** with the Brent experiencing the biggest increase moving from 45.6% to 131.6%.
- **Real Estate** (equity) price moves were all negative: Europe lost 24.5.2%, US lost 29.7%, and Japan lost 24%. **Volatility moves were significantly up**, ranging from 76.5% to 114.5%**. All observed markets ended in a high regime.**
- **PE Funds** lost 3.3% while the **Hedge Funds** lost 6.4%. **Volatility** for the average hedge fund rose from 4.7% to 12.8% (high), while the average PE fund changed from 23% to 32.4%(high).

The Profidata Team

Table of contents

1. Summary volatility matrix p. 4
2. Key News p. 5
3. Kurtosis & correlation in the equity markets p. 6-7
4. Equities p. 8-9
5. Equity Implied Volatility p. 10
6. Fixed Income p. 11
7. Foreign Exchange p. 12
8. (Equity) Options p. 13
9. Commodities p. 14
10. Real Estate (Real Estate Share Prices) & Alternatives p. 15-16

Summary volatility matrix and outlook

As predicted by many experts, COVID-19 has turned into a global pandemic. Most countries are in lockdown and assumed to go into recession. Governments taking unprecedented measures to dampen the effects on economies and citizens. This is taking sovereign debt levels even higher while the ECB is fueling markets in a second “Whatever it takes” scenario. Despite the prevailing concerns about Chinese statistics there seem to be some signs of relieve coming from the region as the lockdown has been relaxed and also the city of Wuhan has been opened.

This has caused mayhem on the financial markets: most of equities down >30%, corporate spreads rising, oil price at lowest levels since decades (also driven by weakened OPEC and price war with Russia).

Worldwide lockdowns aim to flatten the curve of new infections to allow hospitals to better deal with the situation. A cost to bear will be steeper recession curves and further indebtedness of some already highly leveraged countries. Be safe!

ASSET CLASS	AREA	LATEST VOLATILITY	LATEST Z-SCORE	REGIME
EQUITIES	North America	94.1%	4.4	high
	Asia ex-Japan	49.5%	4.9	high
	Europe	66.1%	4.4	high
	Japan (Nikkei)	57.8%	5.3	high
	Energy	130.4%	4.7	high
	Consumer Staples	60.1%	4.4	high
	Financials	96.1%	4.6	high
	IT	95.6%	4.4	high
VOLATILITY OF VOLATILITY	Volatility of VIX	285%	2.2	high
	Volatility of VSTOXX	235%	1.9	high
GOVERNMENT BONDS	Germany	7.7%	4.0	high
	US	7.9%	3.1	high
	Japan	3.4%	2.2	high
	Italy	7.3%	1.8	high
FX VS $	€/$	15.9%	4.6	high
	€/Yen	12.4%	2.9	high
	€/CHF	3.8%	0.2	medium
	€/£	16.9%	3.4	high
COMMODITIES	Oil (Brent)	131.6%	4.0	high
	Gold	42.0%	4.2	high
	Copper	38.3%	5.3	high
	Iron Ore	28.5%	1.0	high
PROPERTY	US	114.5%	4.6	high
	Europe	76.5%	4.7	high
	Japan	98.4%	5.2	high
ALTERNATIVES	HFRX Global HF	12.8%	4.7	high
	Avg PE Fund	32.4%	3.9	high
KURTOSIS	ZCF 1% left (vs -2.33 for normal curve)	-3.37	-0.5	high
CORRELATION	Average market correlation with euro equities	34%	0.5	high

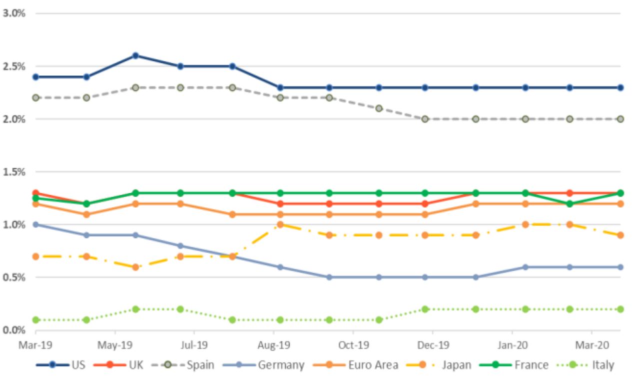
Note: *Throughout the text we refer to volatilities as being "low", "medium" or "High". We define this by defining three equal "sized" regimes over the last 12 months. i.e. “High” volatility implies that volatility is in the upper third of its statistical range over the last 12 months. The table shows the "z-score" of the volatility of each market, i.e. how many standard deviations above (or below) the mean over the last 12 months each market's volatility is.*

Key News

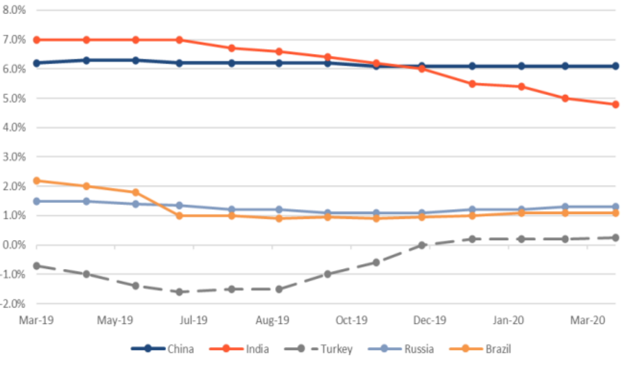
Major Volatility-Driving Events

- Most of the world is in lock-down to fight the spread of the corona virus, which has been classified as pandemic by the WHO. Containment measures aim to flatten the infection curve while of course cutting economic development. Italy and Spain so far hit the hardest with numbers even worse than China, which seems has shown signs of relieve as restrictions on citizens have been waived, also in Wuhan.
- Donald Trump and Boris Johnson heavily criticized for being late taking restrictive measures and their countries currently being among those with the highest growth rates of new infections.
- GDP estimates revised downwards with most of the world´s countries expected to go into recession. Some economists compare the current situation to that of the Spanish flu preceding the Great depression in the 1920´s.
- Equity markets drop more 30% in a turmoil worse than the financial crisis, then turned into a bit of a limbo. Volatilities across the broad at all-time highs.
- Brent at lowest levels in 18 years as recession fears coincide with oil price war between Russia and an OPEC, which seems to be falling apart.
- Most large/mid-caps are expected to suspend payouts given the uncertainty of future cash flows. Retailers, Medcare and New Technology companies are among the few promising sectors.
- Hopes for vaccinations still vague with no clear solution emerging yet. Respirators becoming a scarce product throughout the world.

GDP ESTIMATES FOR 2020, DEVELOPED COUNTRIES



GDP ESTIMATES FOR 2020, DEVELOPING COUNTRIES

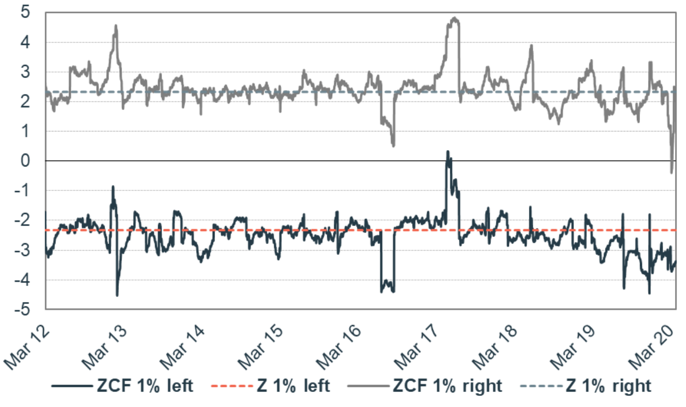


Kurtosis

Correlation in the equity markets

The distribution of risks in European equity market display skewness with the ZCF 1% left at -3.37 and the right ZCF 1% at +2.33 (both as of 1st of April).

Cornish-Fischer expansion of Eurostoxx50 (60 days)



Methodology

To capture a measure of both Skewness and Kurtosis we look at the Cornish-Fischer expansion, which gives a good measure of the tails of the equity market. (We use a 60-calendar day rolling basis). The underlying market we plot is the Eurostoxx 50, but other equity markets normally show very similar results.

We plot on the chart the expected Z-scores for 1% left tail (i.e. a 99% VaR) and a 1% right tail assuming a normal distribution: +/-2.33.

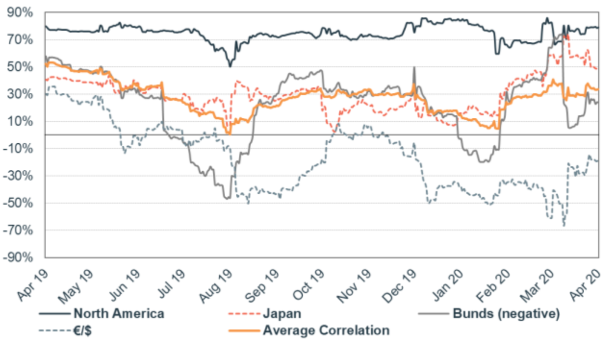
We also show the Cornish-Fischer expansion result for the same market. This indicates how far from a normal distribution each tail was.

On a long-term basis on average the tails are slightly fatter than the normal distribution would suggest, which should not come as a surprise. What is perhaps more surprising is how much variation in fat-tailedness there has been: a daily 99% VaR has varied between -1 and -4.5 standard deviations over time. The biggest variations from +/-2.33 came in 2008, 2010 and 2016.

Inter-market correlations
with EU equities

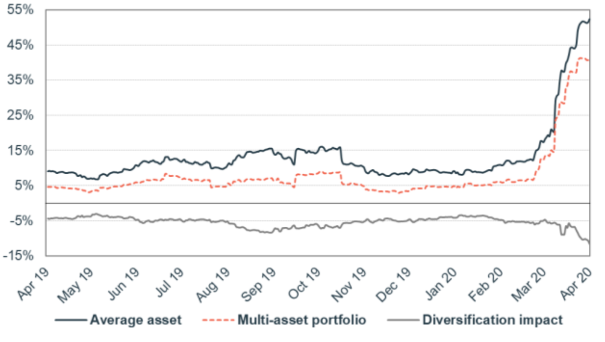
↘ 33.6% AVERAGE CORRELATION

Inter-market correlations (with EU equities)



Correlation decreased during March, leading our average correlation indicator to change from 37.1% to 33.6%.

Multi-asset portfolio volatility



↗ 52.3% AVERAGE VOLATILITIES

↗ 40.6% PORTFOLIO VOLATILITY

We also look at a hypothetical multi-asset portfolio consisting of equities, bonds, gold, oil and hedge funds.

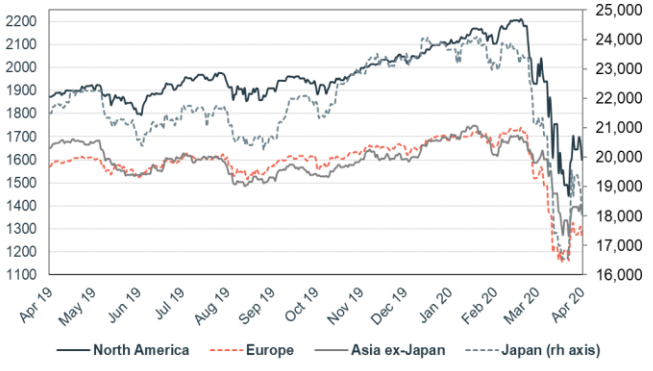
The average asset volatility increased considerably, moving from 20.8% to 52.3 % and the benefit of multi-asset diversification improved, increasing from 6.0% to 11.7%.

In combination, multi-asset portfolio volatility increased from 14.9.0% to 40.6%.

Note: *The chart shows 30-day correlation over time between different markets and the pan-Euro equity market. Higher levels of correlation will in general lead to less ability to diversify risks, and higher portfolio volatility for given position holding volatility.*

Equities
Stock price

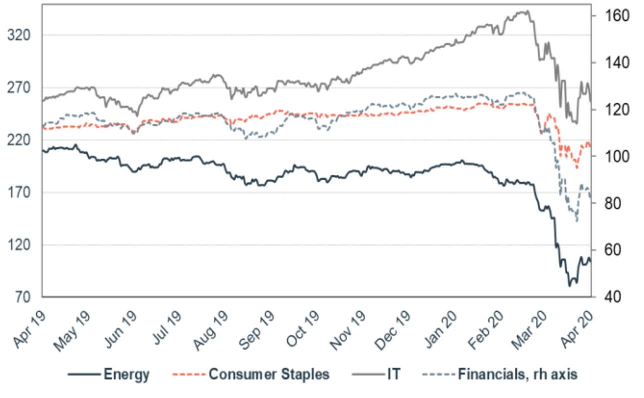
STOCK PRICE PERFORMANCE: REGIONS (LOG SCALES)



-16.5%
Europe

All the equity markets realized losses. North America lost -17.1%, Asia ex-Japan lost -13.4%, Europe lost -16.5%, Japan (Nikkei) lost -14.6%.

STOCK PRICE PERFORMANCE: SECTORS (LOG SCALES)



Sectors movements were also negative and ended up with Energy losing the most.

Energy lost -31.9%, Consumer Staples lost -6.7%, Financials lost -26.4%, IT lost -13.5%.

-26.4%
FINANCIALS

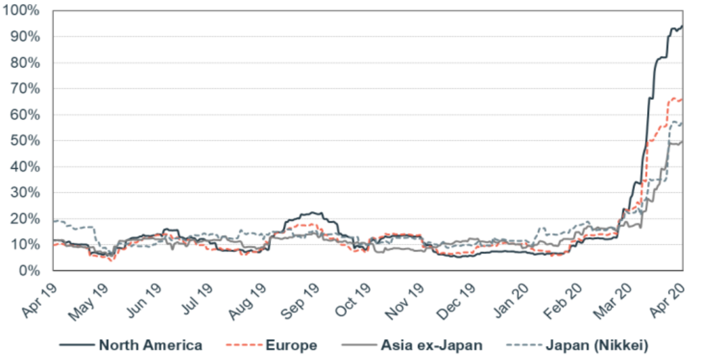
-13.5% IT

-31.9%
ENERGY

- 6.7%
CONSUMER STAPLES

Equities
Volatility

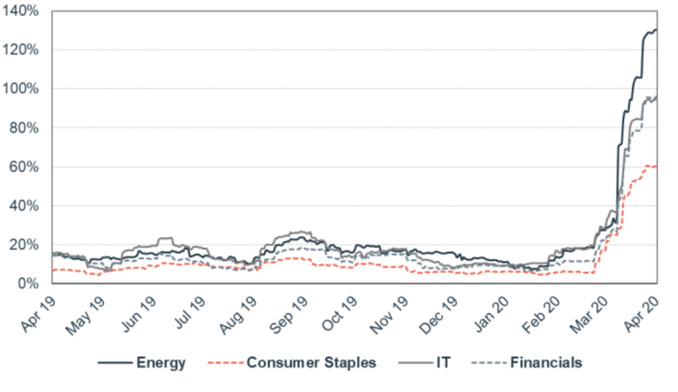
EQUITY VOLATILITY: REGIONS



66.1% EUROPE

All regional volatilities spiked, settling in a high regime. North America rose from 33.9% to 94.1% (high), Asia ex-Japan rose from 18% to 49.5% (high), Europe rose from 26.3% to 66.1% (high), Japan (Nikkei) rose from 24.1% to 57.8% (high).

EQUITY VOLATILITY: SECTORS



Sector volatilities experienced massive spikes as well, all moved further in the high regime.

Energy rose from 33.4% to 94.1% (high), Consumer Staples rose from 25.2% to 60.1% (high), Financials rose from 27.9% to 96.1% (high), IT rose from 37% to 95.6% (high).

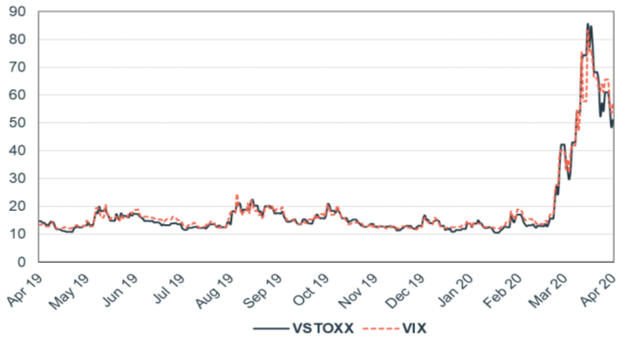
Equity Implied Volatility

Market-Implied Near Term Outlook

Implied Volatility

Implied volatility for both US and EU Markets skyrocketed. VIX rose from 41.9 to 57.1 (high), VSTOXX rose from 43 to 51.1 (high).

IMPLIED VOLATILITY



57.1% VIX

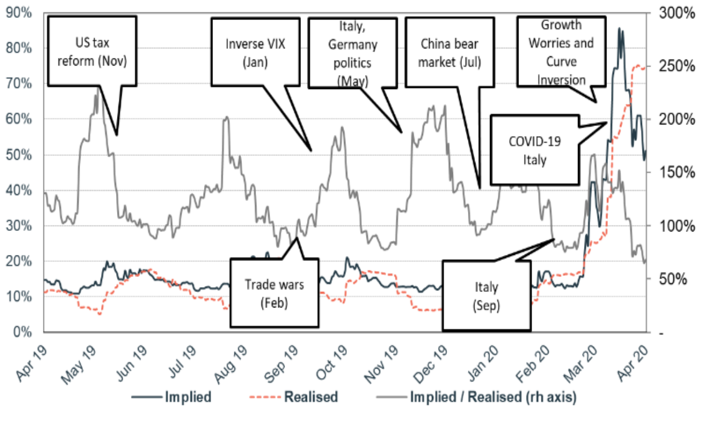
51.1% VSTOXX

Implied vs Realised Volatility

(European equity) implied volatility spike. The realised volatility of the Euro Stoxx 50 index over 30 days moved upwards from 28% to 75% (high) bringing the ratio of implied/realised volatility to move down from 153% to 68%.

This ratio is suggesting that the market is perceiving the present as riskier, in comparation to what is expected to occur in the future; in other words, the realised volatility surpasses the levels of implied volatility.

IMPLIED VS. REALISED VOLATILITY



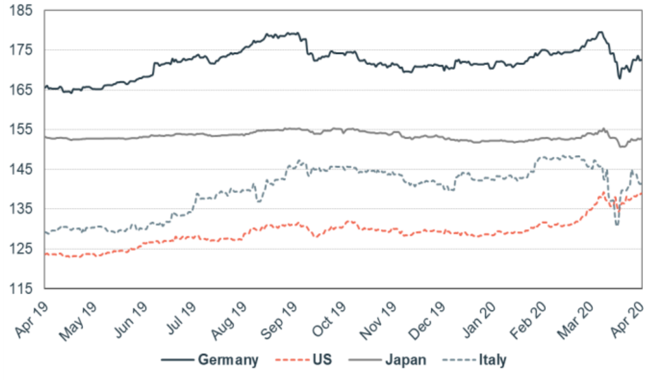
68% IMPLIED/REALISED VOLATILITY

Note: *Note: the implied/realised volatility ratio gives an indication as to whether the market sees an event in the next 30 days (the implied volatility period) which will increase realised volatility (implied/realised >100%, e.g. within 30 days prior to the Greek elections during the Greek crisis) or a period of relative calm after high realised volatility (implied/realised <100%, e.g. immediately after Draghi's calming "whatever it takes" comments).*

Fixed Income

10-Year Government Bond Futures

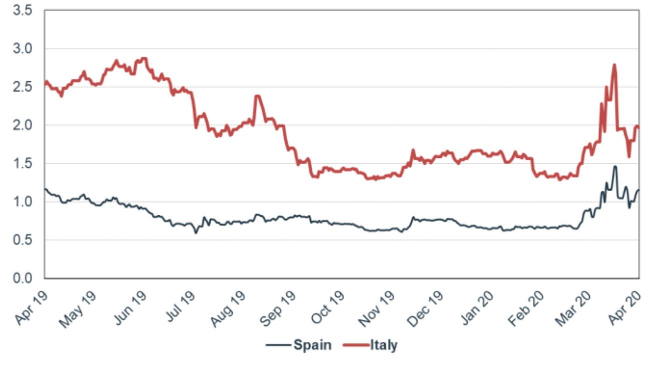
PRICES OF 10Y BOND FUTURES



Prices

Government bond prices movements were mixed, with Germany losing -2.8%, US gained +3.1%, Japan lost -0.9%, Italy stayed neutral at +0.0%.

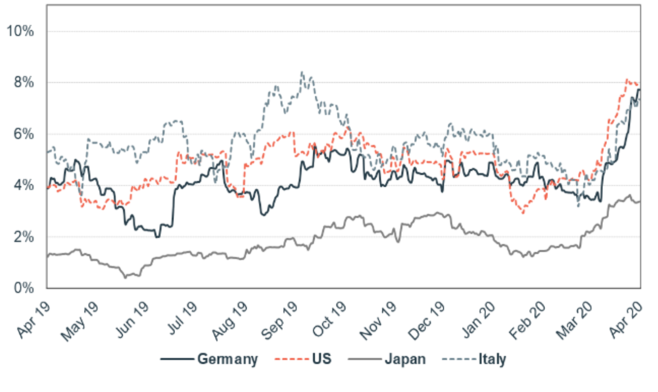
10 YEAR BOND SPREADS OVER GERMANY, %



Italian spreads over Germany increased to 1.97%.

Spanish spreads increased to 1.16%.

VOLATILITY OF 10Y BOND FUTURES



Volatility moves were all upward trending, triggering a regime switch for all observed markets to high.

Germany fell from 3.7% to 7.7% (medium up to high), US rose from 5.0% to 7.9% (high), Japan rose from 2.5% to 3.4% (high), Italy rose from 4.6% to 7.3% (low up to high).

Foreign Exchange

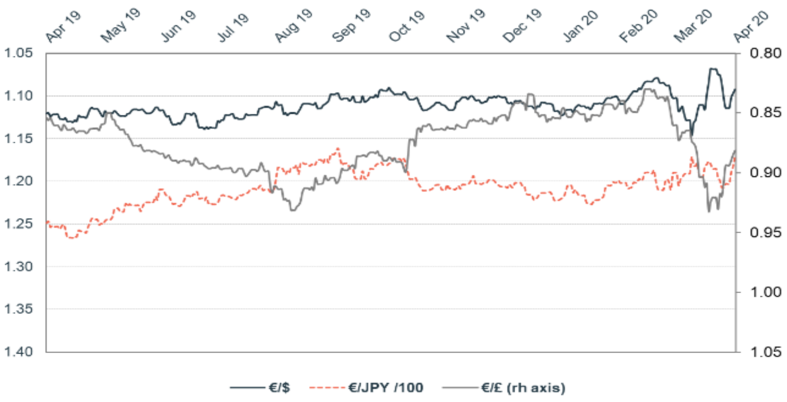
Prices

Currency moves were mixed for the Euro.

Euro lost -0.9% against the US Dollar, Euro lost -1.7% against the Japanese Yen, Euro lost -0.7% against the Swiss Franc, Euro gained +2.5% against the British Pound.

.

FX RATES VS. €

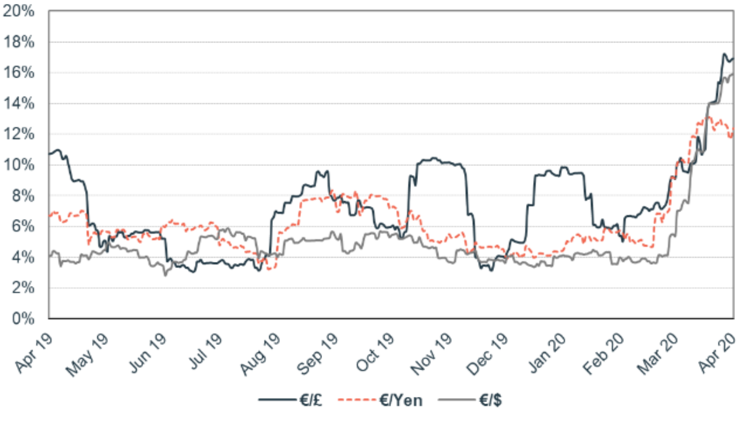


Volatility

FX volatility moves were all upwards and regime switches can be observed.

€/$ rose from 7.7% to 15.9% (high), €/Yen rose from 10.1% to 12.4% (high), €/CHF rose from 3.6% to 3.8% (medium), €/£ rose from 9.6% to 16.9% (high).

VOLATILITY OF FX RATES VS. €



↗ 15.9%
€ vs. $

↗ 16.9%
€ vs. £

↗ 12.4%
€ vs. ¥

__Note:__ The charts show currencies vs. the €. Axes on the first chart are inverted to show conventional currency quotations, but with higher on the chart representing a stronger currency vs. the euro.

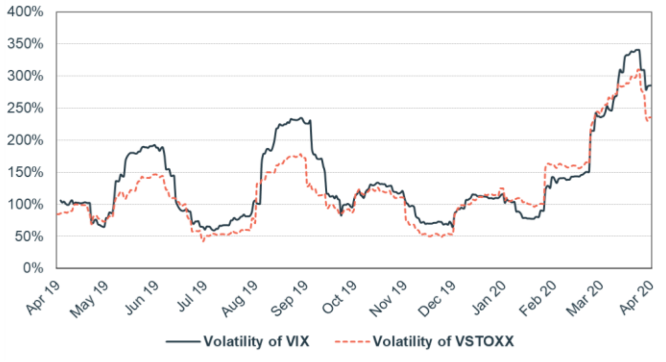
(Equity) Options

Option volatility is mainly driven by the volatility of volatility and moves in prices of the underlying instruments affecting options' deltas.

Implied volatility

Volatility of implied volatility movements were mixed, with Volatility of VIX rose from 248.1% to 285.0% (high), and Volatility of VSTOXX fell from 266.1% to 235.4% (high).

VOLATILITY OF VOLATILITY



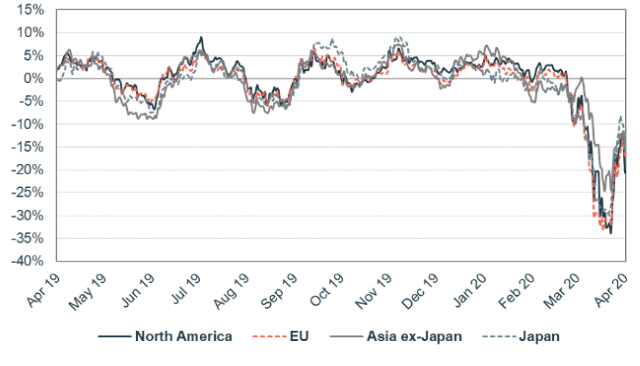
285% US

235.4% EUROPE

Major (Regional Equity) price moves

(Equity) price moves were extremely more volatile compared to recent history, ending the month with a loss position. Price moves are likely to have had a visible impact on option volatility.

CHANGE IN PRICES OF EQUITY INDICES, 30 DAYS



Note on Treatment: *Options show more complex behaviour than the other instruments we look at in this report, so we make some simplifying assumptions. As Calls and Puts are in effect polar opposites and in and out of the money options behave very differently, it is hard to generalise all options' behaviour. However, we look at the two key drivers: volatility of implied volatility and major price movements of the underlying security.*

Implied volatility (via an option's Vega) drives option prices, so a big indicator of option price volatility is the "volatility of implied volatility".

But usually the biggest driver of individual option prices is the movement of the underlying (via the option Delta): a move in either direction will cause the option to go more in or out of the money (and a corresponding change in the option's Delta and price volatility). As a proxy for this, we look at the 30-day price swing of equity market indices; options on bonds or FX could of course behave differently. The 30-day period is relatively close to the time to maturity of many options. Calls and Puts will respond in opposite fashions: calls becoming more volatile (relative to the size of the underlying notional) as prices rise.

Note on Convertibles: *Convertibles are in effect a combination of a bond and a call option, with the bond portion usually making little contribution to the instrument volatility unless the option is significantly out of the money. As such, convertible portfolios' volatilities will tend to behave similarly to call option portfolios, and this commentary can be applied to convertibles as well as options.*

- 51.1% OIL

+ 0.7% GOLD

- 14.6% COPPER

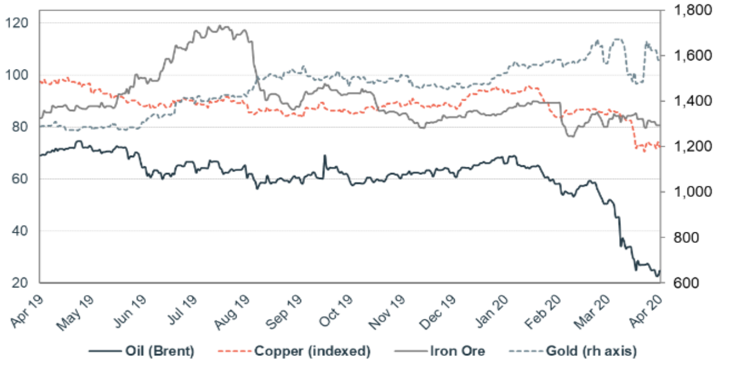
Commodities

Prices

Commodities price moves were mixed.

Oil (Brent) lost -51.1%, Gold gained +0.7%, Copper lost -14.6%, Iron stayed neutral at +0.0%.

COMMODITIES PRICES, $

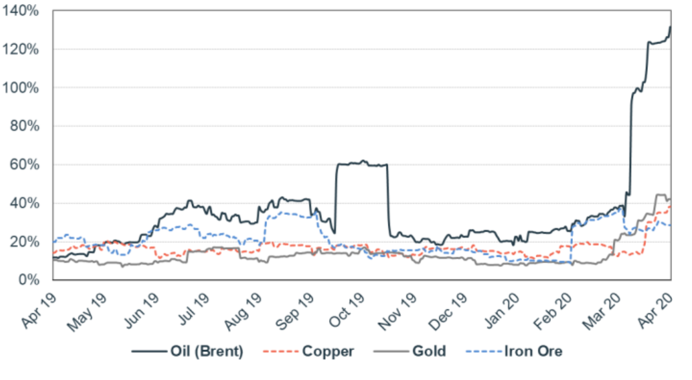


Volatility

Commodity volatility moves were all upward, determining regime switches to high as well.

Oil (Brent) rose from 45.6% to 131.6% (high), Gold rose from 23.4% to 42.0% (high), Copper fell from 14.0% to 38.3% (low up to high), Iron Ore rose from 26.5% to 28.5% (high).

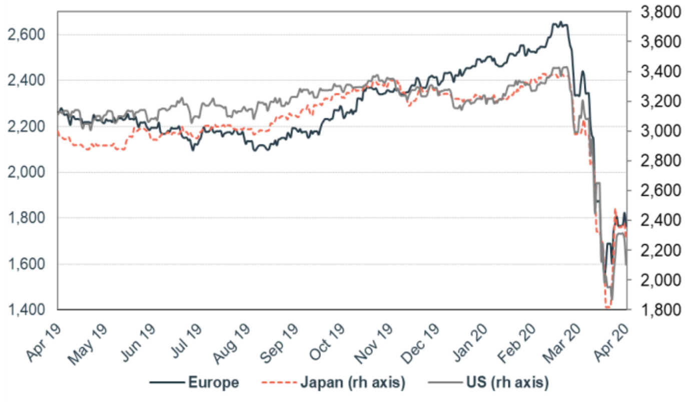
COMMODITIES VOLATILITY



***Note:** all prices refer to near futures rather than spot with the exception of iron ore which is a spot price.*

Real Estate and Alternatives
(Real Estate Share Prices)

REAL ESTATE (REIT) PRICES



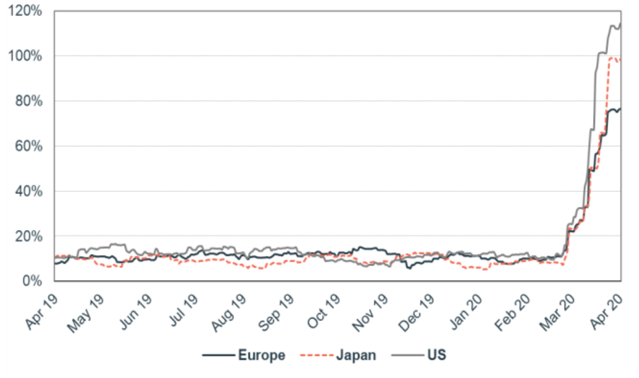
Real estate prices showed a general drop: US lost -29.7%, Europe lost -24.5%, Japan lost -24.0%.

- 24.5% EUROPE

- 29.7% US

-24.0% JAPAN

REAL ESTATE (REIT) VOLATILITY



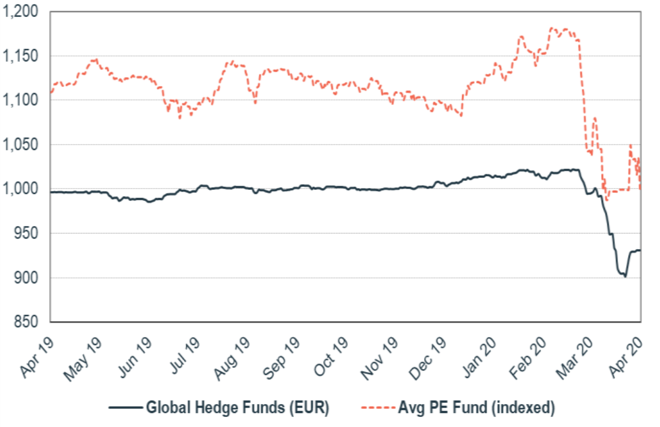
Volatility moves were up, the overall regime is considered now high for all observed markets. US rose from 32.6% to 114.5% (high), Europe rose from 27.1% to 76.5% (high), Japan rose from 26.5% to 98.4% (high).

Note: *Note that for property we look at indices of the share prices of REITs, and not the underlying property directly, for which little real-time data is available. This is usually consistent with funds which tend to invest in property indirectly, e.g. via REITs or property companies.*

As REITs are usually focused on commercial property, residential property may also follow a slightly different pattern to that discussed in this article.

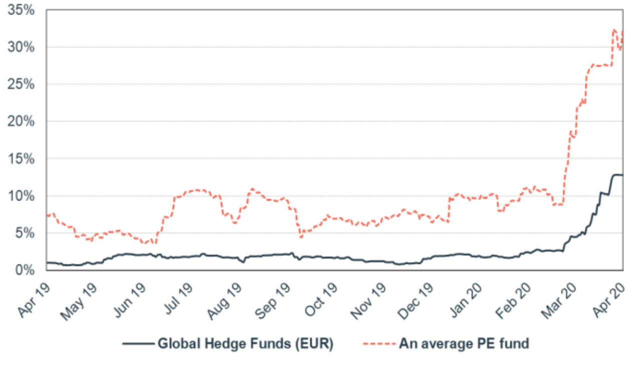
Alternatives

ALTERNATIVES PRICES



The average hedge fund lost -6.4%, an average PE fund lost -3.3%.

AI VOLATILITY



↗12.8% HFRX volatility

↗32.4% AVERAGE PE FUND

The average hedge fund rose from 4.7% to 12.8% (high), an average PE fund rose from 23.0% to 32.4% (high).

Definitions

To avoid repetitions, the term volatility refers to annualised, 30-day average realised volatility in local currency unless otherwise specified. As such, it may be lower than, and lag, shorter-term market volatility in times of high market volatility.

Charts show data up until 09th April 2020, and news and events are included up to that date. The commentary was written on or before 09th April 2020.

Disclaimer

The commentary does not constitute, and is not intended to constitute, investment advice.

Any views expressed in this report are based on historical market data and as such cannot be interpreted as being forward-looking, or to constitute forecasts. Past movements are not necessarily indicative of future movements.

Employees of the Profidata Group may hold positions in securities mentioned.

All expressions of opinion reflect the judgment of the Profidata Group at this date and are subject to change. Information has been obtained from sources considered reliable, but we do not guarantee that the report is accurate or complete.

This document is not for US clients or distribution to the US.

Profidata Group

In der Luberzen 40
8902 Urdorf
Switzerland
+41 44 736 47 47
www.profidatagroup.com